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Pulickel Ajayan

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FOLEY AND LARDNER LLP
SUITE 500
3000 K STREET NW
WASHINGTON, DC 20007

EXAMINER

PATEL, PUNAM

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|--------------------------------------|--|
| Office Action Summary | Application No. 10/537,944 | Applicant(s) AJAYAN ET AL. | |
| | Examiner PUNAM PATEL | Art Unit 2855 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11/12/2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-17,23-35 and 45-53 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1,4-8 and 10-17 is/are allowed.
- 6) ☒ Claim(s) 23, 24, 27, 28, 33-35, and 45-53 is/are rejected.
- 7) ☒ Claim(s) 3, 4, 9, 25, 26, and 29-32 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 November 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

Claims 3, 4, 9, 27, 45, and 46 are objected to because of the following informalities:

With respect to Claim 3, the limitation of "a polymer matrix containing the carbon nanotubes or carbon nanofibers" in lines 2-3 has already been recited in claim 1. Currently, claim 3 is claiming another polymer matrix; this limitation needs to be deleted from claim 3.

With respect to Claim 4, the limitation "of current flowing through", should read "of a current flowing through". Claim 45 should be corrected similarly.

Claims 27 the limitation "of current flowing through", should read "of the current flowing through" in order to have proper antecedent basis (see Claim 24, wherein the limitation of "a current" is already recited).

With respect to Claim 9, the limitation of "the matrix material" in line 4 should read "a polymer matrix film" in order to have proper antecedent basis. The limitation of "the matrix materials comprises a polymer film" in line 7 has already been recited in claim 1. Currently, claim 9 is claiming another polymer film; this limitation needs to be deleted from claim 9.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 23, 24, 27, 28, and 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. (US 6,276,214) in view of Ajayan et al. (P.M. Ajayan, O. Stephan, C. Colliex, D. Trauth. "Aligned Carbon Nanotube Arrays Formed by Cutting a Polymer Resin-Nanotube Composite." *Science*. 1212-1214. Aug. 26, 1994.) and Lau et al. (K. Lau and D. Hui. "The revolutionary creation of new advanced material--carbon nanotube composites." *Composites: Part B*. 33. 263-277. (2002)).

With respect to Claim 23, Kimura et al. disclose a method comprising the steps of:

providing at least one nanosensor in contact with a material (Abstract), the nanosensor comprising conductive channels comprising carbon nanotubes or carbon nanofibers embedded in a polymer material (Abstract, col. 3: 4-5 and 12-14);

receiving information from the nanosensor (col. 7: 55-56, wherein the digital multimeter is read as a detector); and

determining the physical condition of the material based on the information from the nanosensor.

Kimura et al. fail to teach the nanotubes or nanofibers forming a substantially aligned array in the matrix. Ajayan et al. disclose a method of aligning carbon nanotubes/fibers in a polymer matrix material (pg. 1212). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the carbon nanotubes/nanofibers of Kimura et al. by aligning them in the polymer matrix, as disclosed by Ajayan et al. in order to provide a nanosensor with excellent mechanical properties (Ajayan et al., Abstract); to clarify the electrical properties, which are influenced by different nanotubes orientations inside the matrix; and to minimize the distortions that arise when nanotubes cross each other (Lau et al., Abstract, pgs. 268 and 270, understood to occur in a random/raw scattering of nanotubes in a matrix).

With respect to Claim 24, Kimura et al. disclose the method further comprising the step of applying a voltage between a first electrode contacting the carbon nanotubes/fibers on a first portion of a conductive channel and a second electrode contacting the carbon nanotubes/fibers on a second portion of the conductive channel

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such that a current flows through the nanosensor (Abstract & col. 3: 55-61, a power supply must be present to supply a voltage).

With respect to Claims 27 and 45, Kimura et al. disclose the method further comprising the step of determining the physical condition of the material based on the information from the nanosensor in real-time via a computer system (col. 1: 25-27; col. 3: 35-40 and 61-67; and col. 13:11-14, wherein the strain is measured continuously therefore a signal must be received, continuously, from the strain sensor).

With respect to Claims 28 and 46, Kimura et al. disclose the method wherein the current flowing through the nanosensor between the first and second electrode varies due to bending of the carbon nanotubes (Abstract, wherein the data is representative of a change in electric conductivity of the at least one nanosensor & col. 13:11-14, wherein the strain of the material is measured).

With respect to Claims 33 and 47, Kimura et al. in view of Ajayan et al. and Lau et al. disclose the method wherein the material comprises at least one aircraft wing (Abstract, wherein an aircraft is understood to comprise wings), but fail to explicitly disclose the sensor being attached to the wings of the aircraft. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to specifically place the sensors of Kimura et al. in view of Ajayan et al. and Lau et al. on the wings since it was known at the art that all composite surfaces of the aircraft are

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susceptible to strain and it involves only routine skill in the art to attach sensors to said surfaces.

With respect to Claim 34, Kimura et al. in view of Ajayan et al. and Lau et al. disclose the method further comprising the step of analyzing a sample signal received from the at least one nanosensor, but fail explicitly disclose comparing the signal received from the at least one sensor to a baseline. It is notoriously well known in the art of structural health monitoring to first store an initial/baseline measurement of the parameter/property of the structure being measured such that subsequent measurements of the parameter maybe compared against the baseline measurements. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the method of Kimura et al. in view of Ajayan et al. and Lau et al. to include the step of comparing measured values to a baseline value in order to determine if the strain measurements are indicative of structural damage.

With respect to Claims 35 and 49-53, Kimura et al. disclose the method further comprising the step of providing the real time physical condition of the aircraft to at least one of a flight crew and a ground crew (col. 13:11-14, wherein it is understood that the data from the aircraft sensors is provided to an aircraft crew).

With respect to Claim 48, Kimura et al. disclose the method wherein the nanosensor is operable as a reinforcing material (Abstract, col. 3: 4-5 and 12-14,

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wherein it is understood that carbon nanotube composites function as structural reinforcing material).

Response to Arguments

Applicant's arguments with respect to claims 1, 3-17, 23-35, and 45-53 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

Claims 1 and 3-17 are allowed. Note claim objections for claims 3, 4, and 9 above.

Claims 25, 26, and 29-32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PUNAM PATEL whose telephone number is (571)272-6794. The examiner can normally be reached on Monday to Friday 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lisa Caputo can be reached on (571) 272-2388. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PP
02/03/2009

/Lisa M. Caputo/
Supervisory Patent Examiner, Art Unit 2855